Working with CERES Data to Test Parameterizations in CAM

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Outline

- Using CERES to test CAM parameterizations in "forecast mode"
- Why does "CAM4" have a low bias in clear-sky OLR?
- Using the new CERES-CloudSat-CALIPSO-MODIS Seiji Kato is producing
- Some examples of using the CAVE data
- Some questions from the climate community
  - Is the difference between what NCAR is providing the community and what LARC produces significant?
  - Data distribution – what to use?

Simulations

- Weather forecast simulations are started every day in the period January – February 2006 with the ECMWF operational analysis
- Two model versions are examined:
  - CAM3.6 (CAM3_5_35) which has CAMRT + MG Microphysics + HB PBL + Hack ShCu
  - CAM4 (CAM3-6-16dev07) which has RRTM + MG Microphysics + UW PBL/ShCu + Ice Supersaturation (+ Cloud Macrophysics?)

Question: Why does "CAM4" have a low bias in clear-sky outgoing longwave radiation?

Answer: This result from drifts in middle & lower tropospheric water vapor (moist) and temperature (cold) which are particularly prominent in tropical regions adjacent to the deep convection regions.

Possible Causes: Overactive shallow and deep convection? Bad interactions between shallow and deep convection?

Development versions

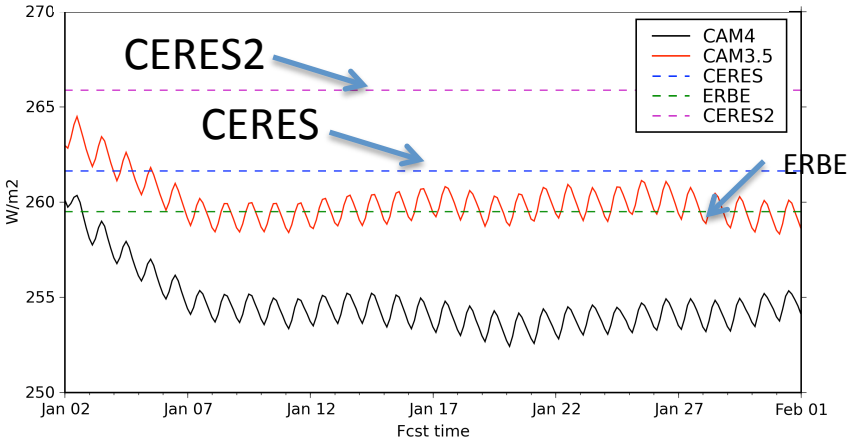
- "CAM4" hasn't been officially named
  - May not be the version used for the next IPCC
  - Will be announced at the CCSM workshop later this year

Using CERES to help with development

- Testing a new radiation parameterization
- Needed the latest CERES data from Dave Doelling – SRBAVG GEO
- RRTM tests

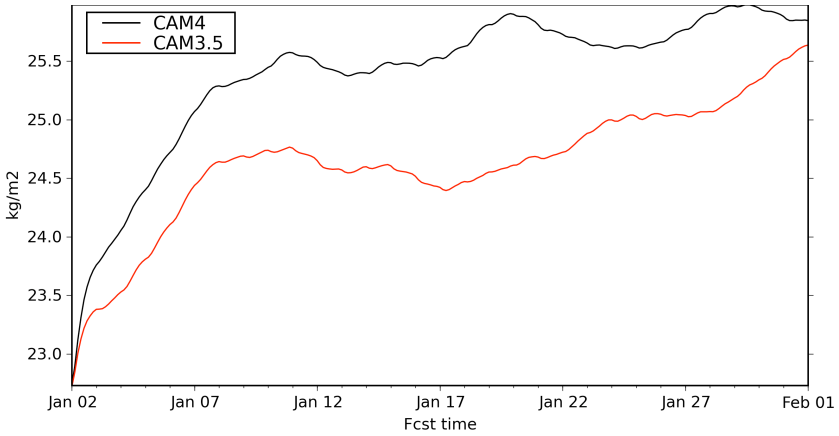
Drifts in Global Means from initial values

Clear Sky OLR

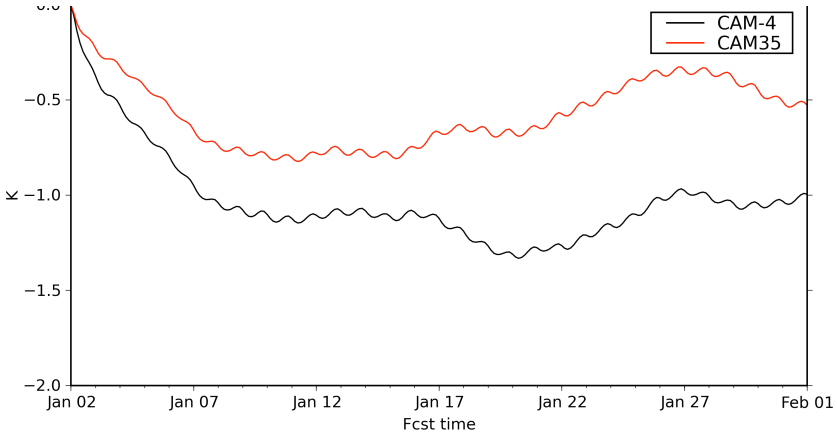


- *With ECMWF analysis, CAMRT or RRTM produces a global mean clear-sky OLR within the range of observational estimates at the start of the forecast*
- *Difference in initial value is consistent with offline comparisons of CAMRT and RRTM*
- *Drift to 'climate' occurs over ~5 days is well correlated with moist and cold drifts*

Column Water Vapor



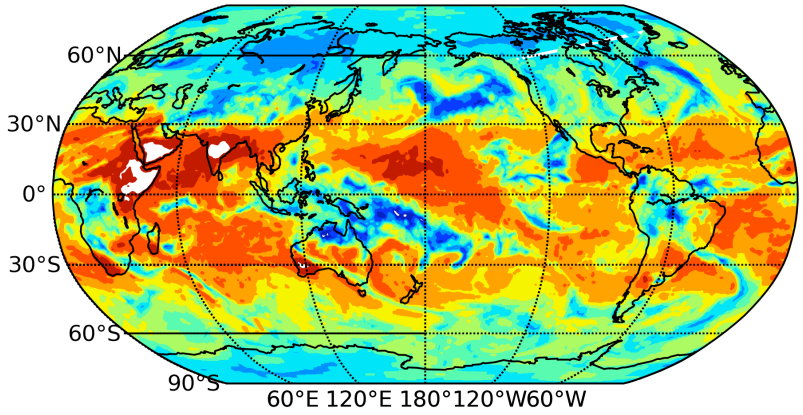
Temp beneath 300 hPa



SRBAVG-GEO-hourly OLR Snapshot:

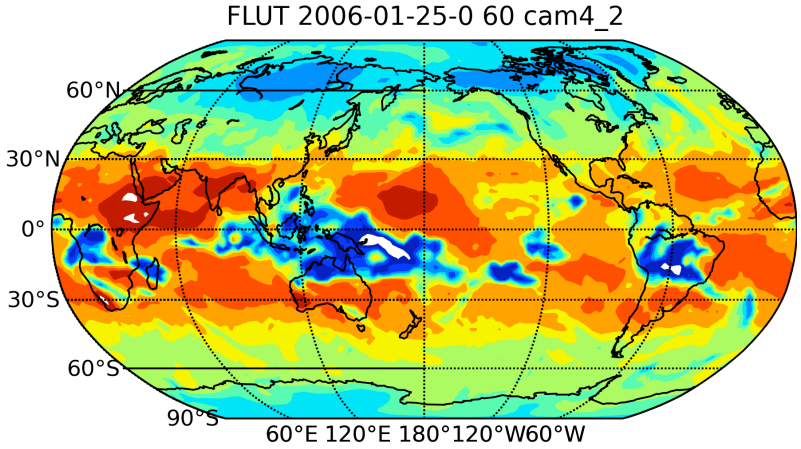
12Z, January 27, 2006

CERES

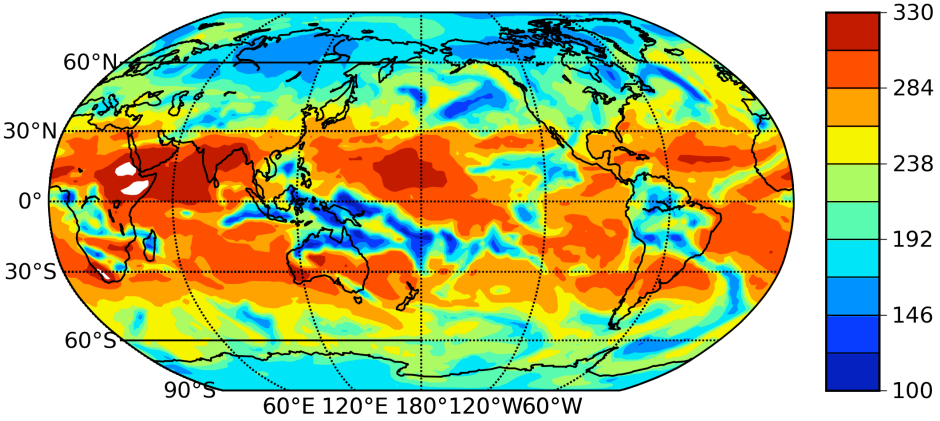


- *A sixty-hour CAM forecast does a reasonable job positioning midlatitude and even some tropical systems*
- *CAM4's midlatitude systems lack a strong OLR signature*
- *CAM4's tropical systems have a bit too strong OLR signature*

"CAM4"



CAM3.6

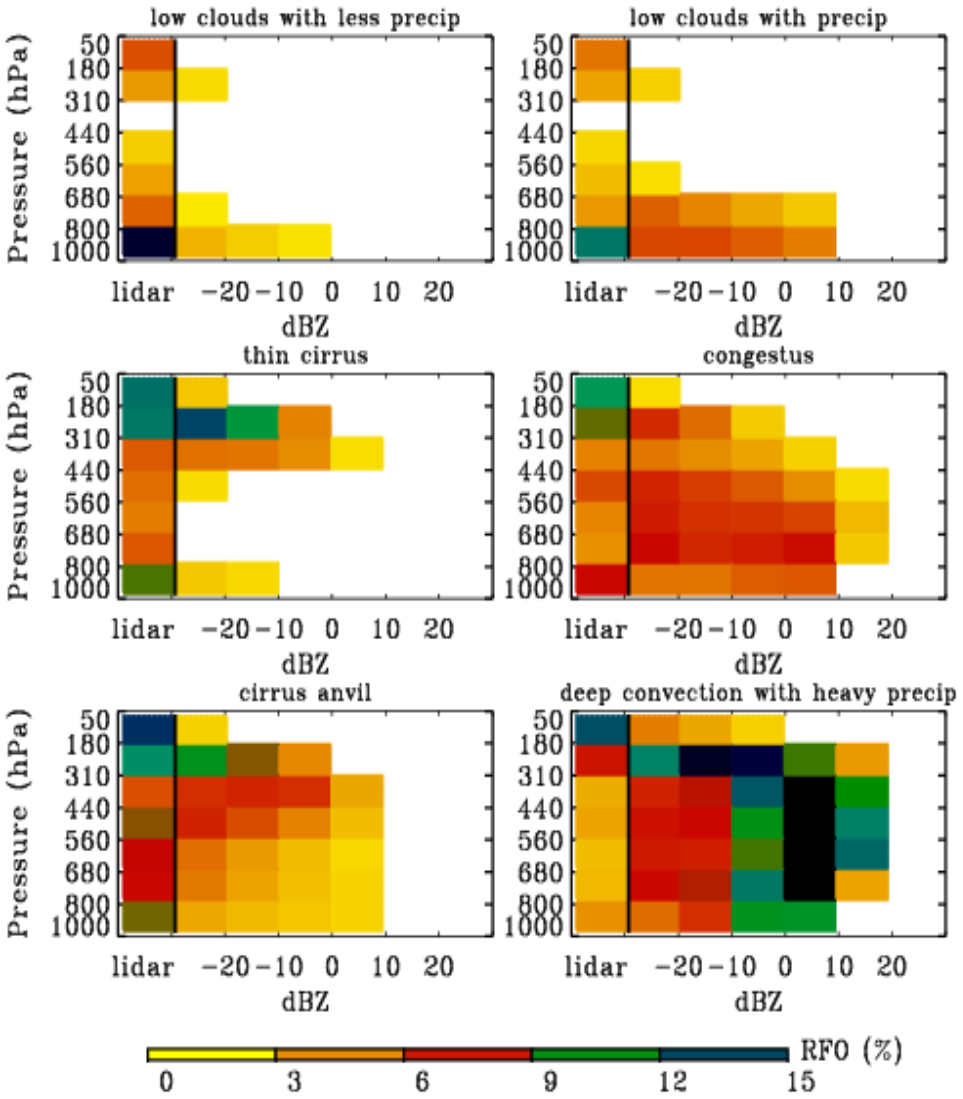


W m^{-2}

Yuying Zhang has analyzed the CAM and compared with the new CERES-CLOUDSAT-MODIS product

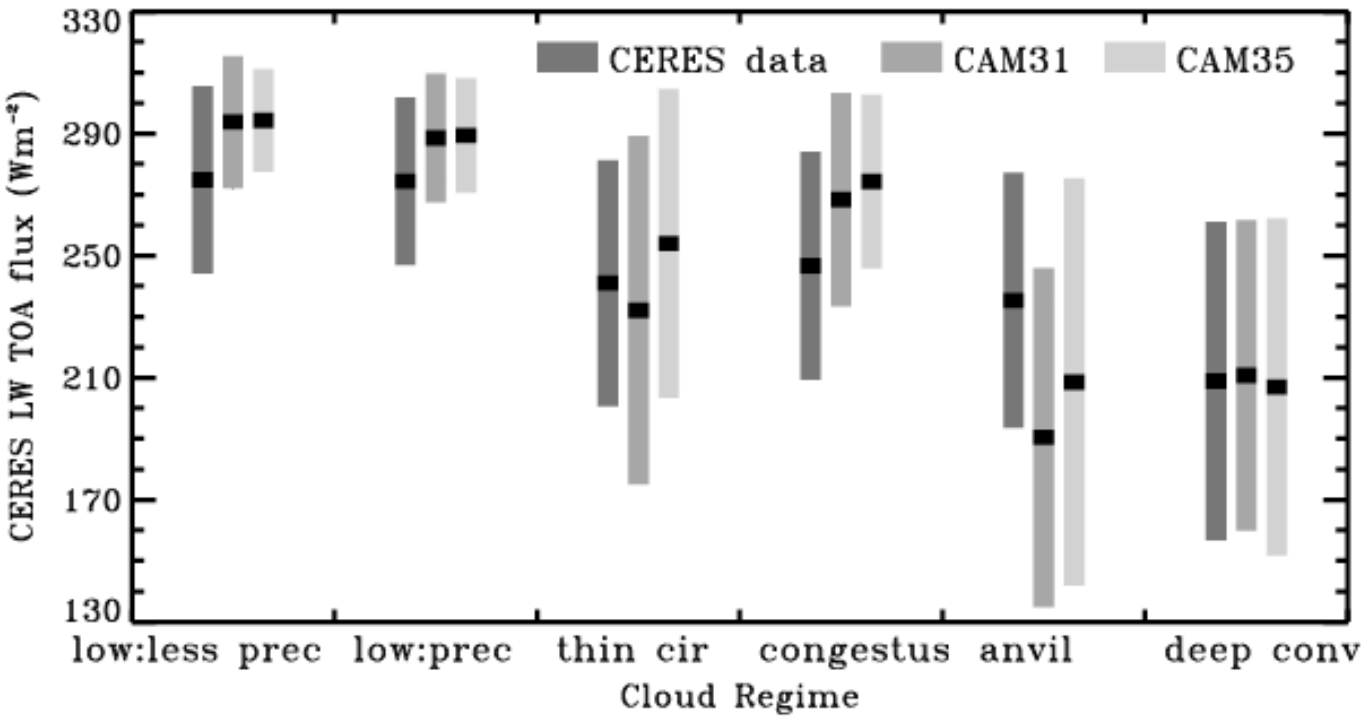
- Cluster analysis for comparison with CloudSat simulator in climate models
- Similar to ISCCP histograms
- 6 clusters emerge in the tropics (30N-30S)

Six distinctive cloud regimes are found from combined CloudSat and CALIPSO data cloud mesoscale patterns geographical maps



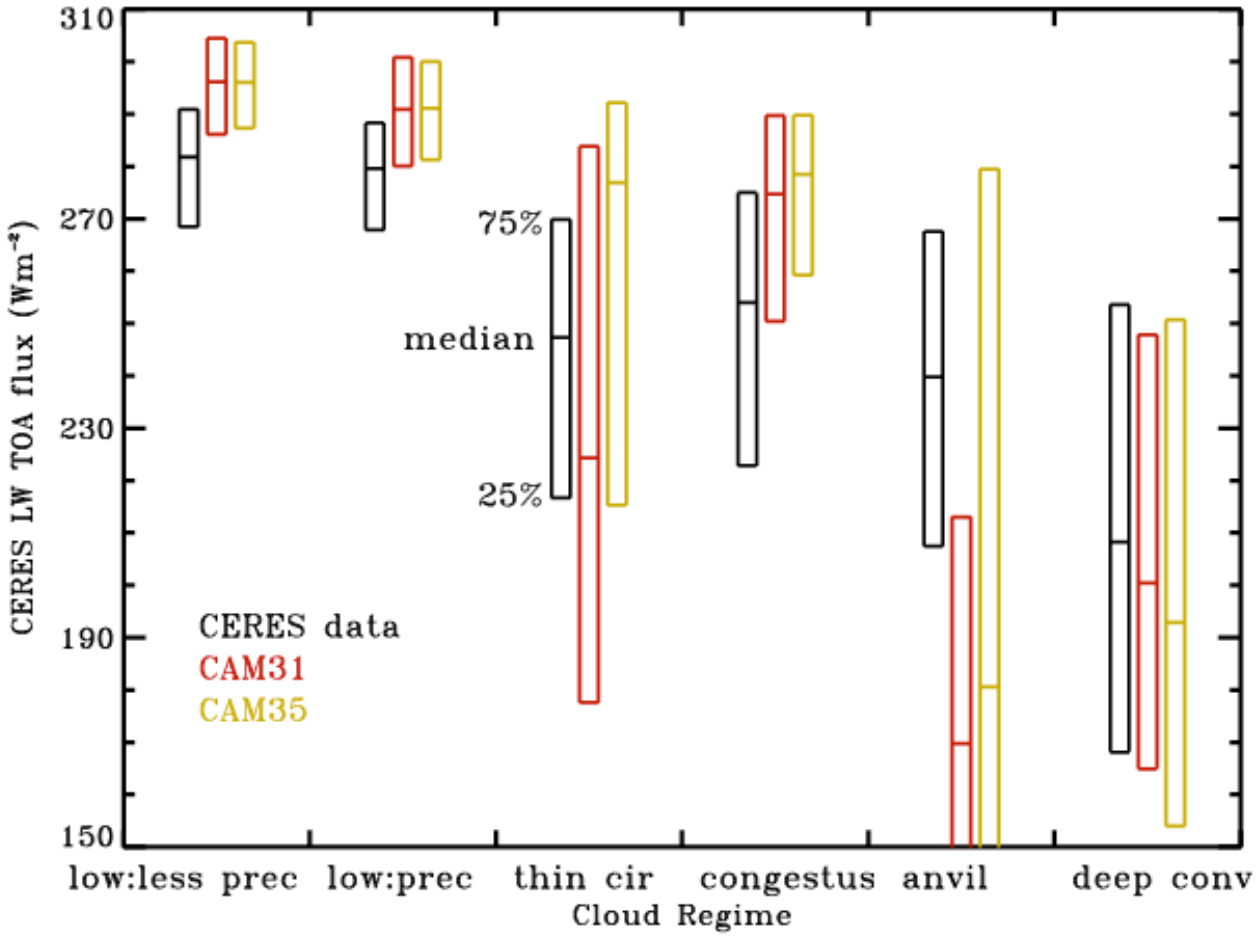
CERES (CCCM) LW TOA flux are composited to each cloud regimes defined by CloudSat and CALIPSO data.

mean with standard deviation.



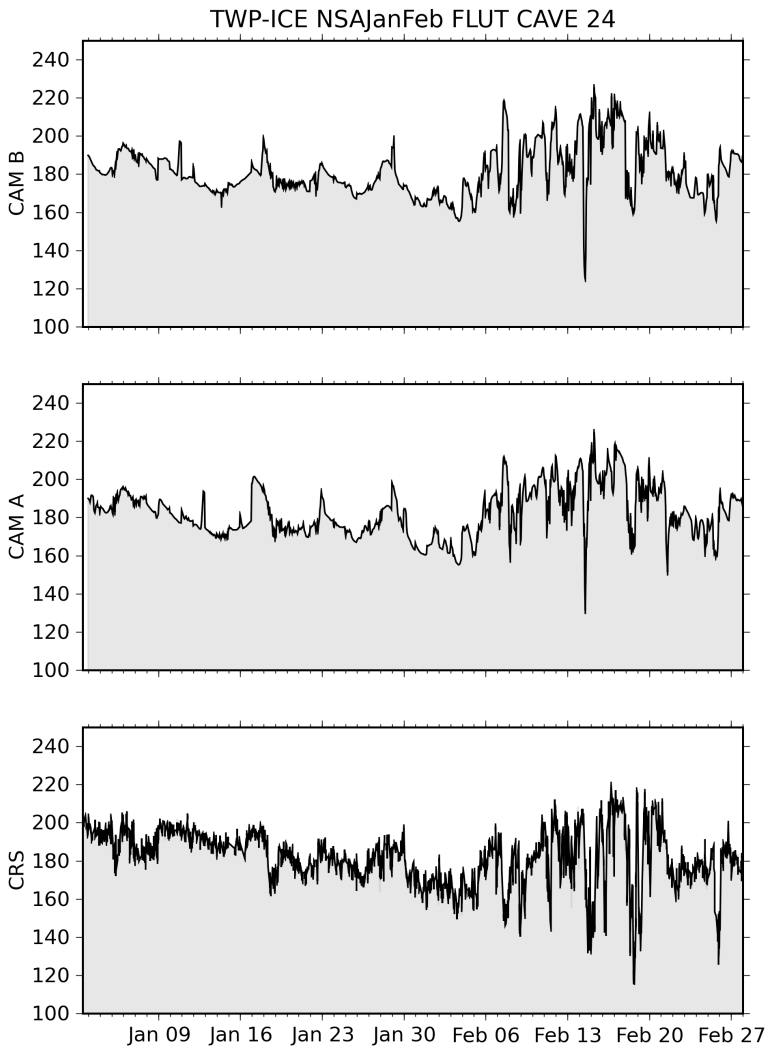
CERES (CCCM) LW TOA flux are composited to each cloud regimes defined by CloudSat and CALIPSO data.

median and the 25% and the 75% values

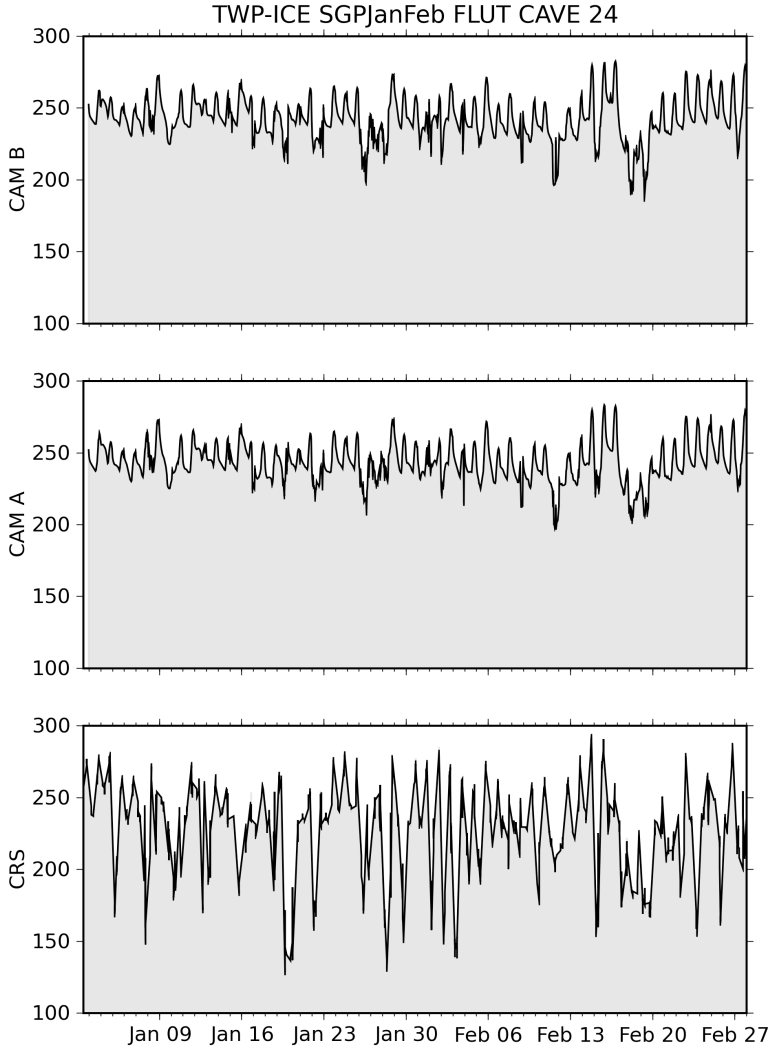


Cloud microphysics changes: Comparison with the CAVE data

OLR North Slope of Alaska day 2 forecast



OLR Southern Great Plains day 2 forecast

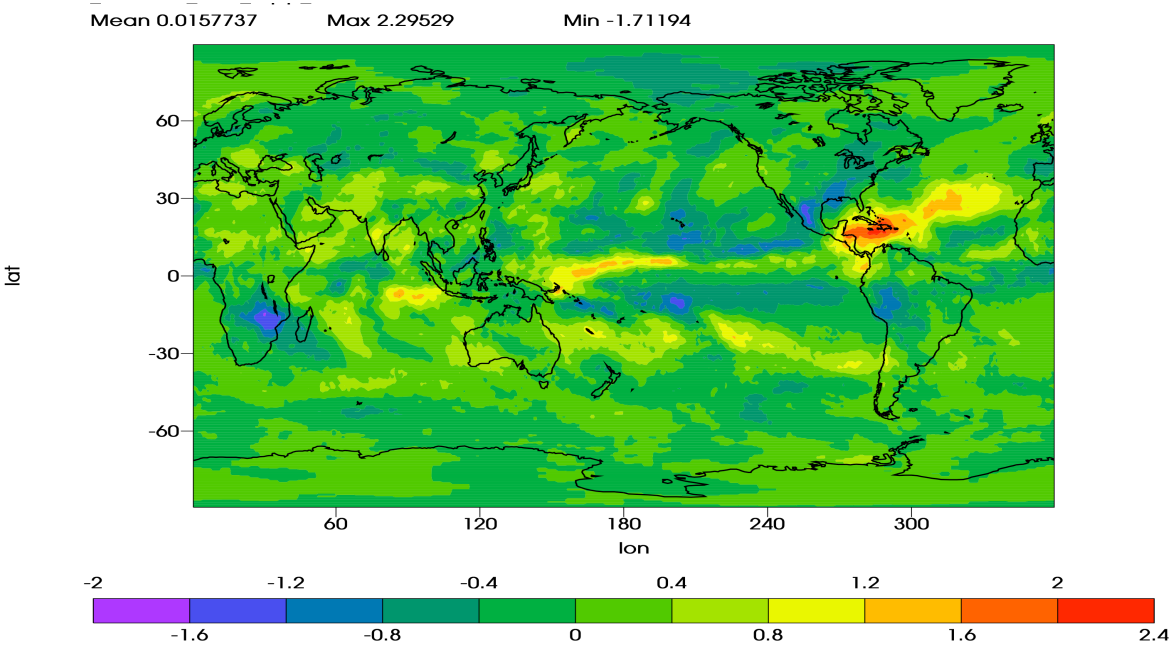


A new project at LLNL is looking at uncertainty

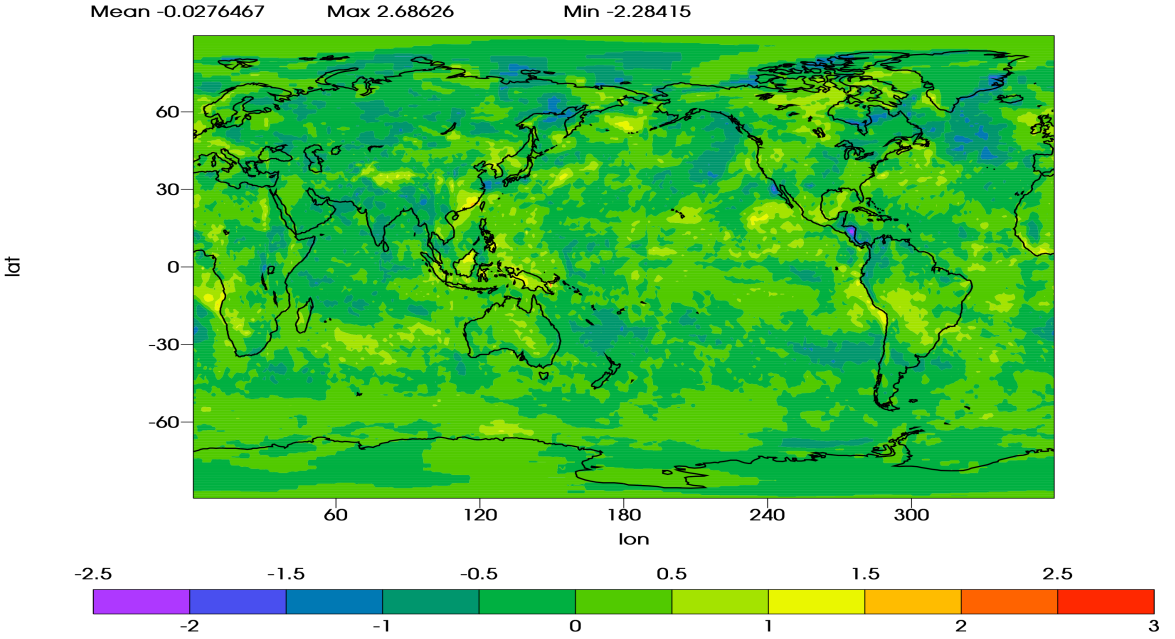
- Needed an observational data set – CERES
- Using NCAR's version of EBAF
  - Slightly different from the product on NCAR's diagnostic web page
  - Net imbalance quite close
  - OLR has a small systematic difference

Annual mean of 5-year climatology

Difference between NASA Langley furnished OLR (EBAF) and that furnished by NCAR http://www.cgd.ucar.edu/cms/rneale/tools/amwg_mean_diagnostics.html



Difference between NASA Langley furnished NET flux (EBAF) and that furnished by NCAR http://www.cgd.ucar.edu/cms/rneale/tools/amwg_mean_diagnostics.html



Other Issues

- CERES for use by climate modeling community
  - Model evaluation in particular
  - Choice of products
  - "best" product
    - Edition etc.
    - Format issues
    - Standards
  - Earth System Grid – as a possibility
    - JPL and GSFC